

Package ‘JMdesign’

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Type Package

Title Joint Modeling of Longitudinal and Survival Data - Power Calculation

Version 1.1

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Description Performs power calculations for joint modeling of longitudinal and survival data with k-th order trajectories when the variance-covariance matrix, Sigma_theta, is unknown.

License GPL-2

Depends methods

NeedsCompilation no

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JMdesign-package *Joint Modeling of Longitudinal and Survival Data - Power Calculation*

Description

R function for power determination in joint modeling of longitudinal and survival data with k-th order trajectories and unknown variance-covariance matrix Sigma_theta.

Details

```

Package: JMdesign
Type: Package
Version: 1.1
Date: 2014-10-21
License: GPL-2

```

The package contains the R-function `powerLongSurv` to perform power calculations for joint modeling of longitudinal and survival data when trajectories are of k -th order and the variance-covariance matrix `Sigma_theta` is unknown.

Author(s)

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References

L. M. Chen, J. G. Ibrahim, and H. Chu. Sample size and power determination in joint modeling of longitudinal and survival data. *Statist. Med.* 2011, 30 2295-2309

See Also

[powerLongSurv](#), [powerLongSurv-class](#), [show-methods](#)

Examples

```

## Example 1.
## *****
## Input elements of Sigma_theta in formula 4.6;
SigmaTheta <- matrix(c(1.2,0.0,0.0,0.0,0.0,0.7,0.0,0.0,0.0,0.8),nrow=3,ncol=3)

N      <- 200; # Total sample size;
nevents <- 140; # Number of events;
tmedian <- 0.7; # median survival;
meantf <- 1.4; # mean follow-up time;
beta    <- 0.2; # Effect of the trajectory;
alpha   <- 0.05; # Type-I Error (2-sided);
sigmae_2 <- 0.09; # measurement error;

## schedule of measurement;
t <- c(0.4, 0.8, 1.2, 1.6, 2) ; # maximum 2 year follow-up;

## Input estimated proportion subjects with 2,3,4,5,6 measurements;
## This is \xi in formula 4.6;
## The data is obtained from the simulated data for the calculation in table 2;
p <- c(0.3, 0.4, 0.15, 0.1, 0.05);

## Input the order of trajectories
ordtraj <- 1 ## linear trajectories

```

```

## Call function
## Linear Trajectories
pLSl <- powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta,
                      sigmae_2, ordtraj, beta, alpha=0.05)

pLSl
show(pLSl)
unclass(pLSl)

## Constant Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=0, beta, alpha=0.05)

## Quadratic Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=2, beta, alpha=0.05)

## *****

## Example 2.
## *****
## Input elements of Sigma_theta in formula 4.6;
SigmaTheta <- matrix(c(1.2,0.0,0.0,0.0,0.7,0.0,0.0,0.0,0.8),nrow=3,ncol=3)

N      <- 200; # Total sample size;
nevents <- 140; # Number of events;
tmedian <- 0.7; # median survival;
meantf <- 1.4; # mean follow-up time;
beta    <- 0.2; # Effect of the trajectory;
alpha   <- 0.05; # Type-I Error (2-sided);
sigmae_2 <- 0.09; # measurement error;

## schedule of measurement;
t <- c(0.4, 0.8, 1.2, 1.6);

## Input estimated proportion subjects with 2,3,4,5,6 measurements;
## This is \xi in formula 4.6;
## The data is obtained from the simulated data for the calculation in table 2;
p <- c(0.3, 0.4, 0.2, 0.1);

## Input the order of trajectories
ordtraj <- 2 ## quadratic trajectories

## Call function
## Quadratic Trajectories
pLSq <- powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta,
                      sigmae_2, ordtraj, beta, alpha=0.05)

pLSq
show(pLSq)
unclass(pLSq)

## Constant Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,

```

```

ordtraj=0, beta, alpha=0.05)

## Linear Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=1, beta, alpha=0.05)

```

powerLongSurv *Power calculation in joint modeling of longitudinal and survival data
- k-th Order Trajectories and Unknown Sigma*

Description

Compute the power in joint modeling of longitudinal and survival data when the variance-covariance matrix Sigma_Theta is unknown and the trajectories are order k.

The function computes power for a one-sided test, either

$$H_0 : \beta = 0 \quad \text{and} \quad H_{1A} : \beta > 0$$

or

$$H_0 : \beta = 0 \quad \text{and} \quad H_{1B} : \beta < 0$$

with Type I error α . The choice of the alternative is determined by the sign of β . Negative values for β indicate that the alternative hypothesis is H_{1B} , while $\beta \geq 0$ indicates that it is H_{1A} .

It creates a powerLongSurv object.

Usage

```

powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2, ordtraj,
              beta = 0, alpha = 0.05, tol = 1.5e-8)

```

Arguments

N	numeric specifying the total sample size; minimum 20.
nevents	numeric specifying the number of events; at least 20 and at most N.
tmedian	numeric specifying the median survival time; positive
meantf	numeric specifying the mean follow-up time; positive and no greater than max(t).
p	numeric vector of estimated subject proportions with 2,3,... measurements, respectively, zero proportions allowed.
t	numeric vector of measurement times, distinct positive components; same length as p.
SigmaTheta	numeric matrix specifying the covariance matrix Sigma_Theta
sigmae_2	numeric specifying the measurement error; positive.
ordtraj	integer specifying the order of trajectories, must be less the order of Sigma_Theta
beta	numeric specifying the effect of the trajectory; default value 0.
alpha	numeric, strictly between 0.0 and 1.0, specifying the Type-I Error (2-sided), default value 0.05.
tol	numeric, For floating point objects x and y, if $ x-y \leq \text{tol}$, $x==y$. Passed to R function all.equal.

Details

The function `powerLongSurv` is used to calculate the power in joint modeling of longitudinal and survival data.

Value

An object of S4 class `powerLongSurv`, which has the following 12 components

<code>title</code>	character string
<code>subtitle</code>	character string
<code>t</code>	numeric vector
<code>p</code>	numeric vector
<code>N</code>	integer
<code>nevents</code>	integer
<code>censr</code>	numeric
<code>tmedian</code>	numeric
<code>meantf</code>	numeric
<code>SigmaTheta</code>	numeric matrix
<code>ordtraj</code>	integer
<code>BSigma</code>	numeric matrix
<code>beta</code>	numeric
<code>alpha</code>	numeric
<code>power</code>	numeric

Author(s)

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Maintainer: Shannon T. Holloway <sthollow@ncsu.edu>

References

L. M. Chen, J. G. Ibrahim, and H. Chu. Sample size and power determination in joint modeling of longitudinal and survival data. *Statist. Med.* 2011, 30 2295-2309

See Also

[powerLongSurv-class, show-methods](#)

Examples

```

## Example 1.
## *****
## Input elements of Sigma_theta in formula 4.6;
SigmaTheta <- matrix(c(1.2,0.0,0.0,0.0,0.7,0.0,0.0,0.0,0.8),nrow=3,ncol=3)

N      <- 200; # Total sample size;
nevents <- 140; # Number of events;
tmedian <- 0.7; # median survival;
meantf <- 1.4; # mean follow-up time;
beta <- 0.2; # Effect of the trajectory;
alpha <- 0.05; # Type-I Error (2-sided);
sigmae_2 <- 0.09; # measurement error;

## schedule of measurement;
t <- c(0.4, 0.8, 1.2, 1.6, 2) ; # maximum 2 year follow-up;

## Input estimated proportion subjects with 2,3,4,5,6 measurements;
## This is \xi in formula 4.6;
## The data is obtained from the simulated data for the calculation in table 2;
p <- c(0.3, 0.4, 0.15, 0.1, 0.05);

## Input the order of trajectories
ordtraj <- 1 ## linear trajectories

## Call function
## Linear Trajectories
pLS1 <- powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta,
                      sigmae_2, ordtraj, beta, alpha=0.05)
pLS1
show(pLS1)
unclass(pLS1)

## Constant Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=0, beta, alpha=0.05)

## Quadratic Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=2, beta, alpha=0.05)

## *****

## Example 2.
## *****
## Input elements of Sigma_theta in formula 4.6;
SigmaTheta <- matrix(c(1.2,0.0,0.0,0.0,0.7,0.0,0.0,0.0,0.8),nrow=3,ncol=3)

N      <- 200; # Total sample size;
nevents <- 140; # Number of events;
tmedian <- 0.7; # median survival;
meantf <- 1.4; # mean follow-up time;

```

```

beta    <- 0.2; # Effect of the trajectory;
alpha   <- 0.05; # Type-I Error (2-sided);
sigmae_2 <- 0.09; # measurement error;

## schedule of measurement;
t <- c(0.4, 0.8, 1.2, 1.6);

## Input estimated proportion subjects with 2,3,4,5,6 measurements;
## This is \xi in formula 4.6;
## The data is obtained from the simulated data for the calculation in table 2;
p <- c(0.3, 0.4, 0.2, 0.1);

## Input the order of trajectories
ordtraj <- 2 ## quadratic trajectories

## Call function
## Quadratic Trajectories
pLSq <- powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2, ordtraj, beta, alpha = 0.05)
pLSq
show(pLSq)
unclass(pLSq)

## Constant Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=0, beta, alpha=0.05)

## Linear Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=1, beta, alpha=0.05)

```

```
powerLongSurv-class   Class "powerLongSurv"
```

Description

Class of objects like the output of function "powerLongSurv()".

Objects from the Class

Objects can be created by calls of the form `new("powerLongSurv", ...)`.

Slots

title: Object of class "character"
subtitle: Object of class "character"
t: Object of class "vector"
p: Object of class "vector"
N: Object of class "integer"

```
nevents: Object of class "integer"  
censr: Object of class "numeric"  
tmedian: Object of class "numeric"  
meantf: Object of class "numeric"  
SigmaTheta: Object of class "matrix"  
ordtraj: Object of class "integer"  
BSigma: Object of class "matrix"  
beta: Object of class "numeric"  
alpha: Object of class "numeric"  
power: Object of class "numeric"
```

Methods

```
show signature(object = "powerLongSurv")
```

Author(s)

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Maintainer: Shannon T. Holloway <sthollow@ncsu.edu>

See Also

[powerLongSurv](#), [show-methods](#)

Examples

```
showClass("powerLongSurv")
```

show-methods

Methods for Function show

Description

Methods for function show

Methods

```
signature(object = "powerLongSurv")
```

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